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BUILDING KNOWLEDGE-BASED ECONOMIES IN AFRICA: A SYSTEMATIC REVIEW OF POLICIES AND STRATEGIES

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Abstract

Compared to other regions of the world, Africa is lagging in its drive toward knowledge-based economies. This study systematically reviews the literature in order to highlight the policies and strategies with which African countries can accelerate their current drive towards building knowledge-based economies. These are discussed in terms of three pillars of the World Bank's knowledge economy framework. They are the indices for: (i) education and skilled population, (ii) information and communication technology and (iii) economic incentives and institutional regime.

Keywords: Knowledge economy; Development; Africa

JEL Classification: O10; O30; O38; O55; O57

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1. Introduction

It is a proven fact that in this contemporary époque, for nations to survive the challenges of globalisation, they need knowledge-based economies (KBEs) (Tchamyou 2017; Parcero and Ryan 2017; Vadra 2017). KBEs which are essential for competition in the 21st century, have been at the centre of key policy reports from the Organisation for Economic Co-operation and Development (OECD) and the World Bank during the past decade (Tchamyou 2017; Amavilah et al. 2017; Gama et al. 2018; Asongu 2017a; Asongu and Tchamyou 2019a). It is within this policy framework that the relevance of KBE has been mastered by North America, Japan and Europe, which have inexorably been determining the pattern of economic development in the international arena. While other developing countries in Latin America and Asia have been catching-up with calculated moves that emphasise the importance of KBE in the pursuit of their regional and national goals (Tchamyou 2017; Chandra and Yokoyama 2011; Dahlman 2007; Shahabadi et al. 2017)[4], the overall index of knowledge economy (KE) in Africa has been decreasing since the beginning of the third Millennium (Anyanwu 2012).

In order for African countries to brace the challenge of globalisation, appropriate policies are needed to catch-up with frontier countries (Asongu 2016). Unfortunately, the existing literature has failed to provide a logical structure for the policies and strategies with which to enhance the knowledge economy in Africa. This paper bridges the underlying gap by summarising what we know so far about measures with which African countries can accelerate their march toward KBE.

For the most part, the literature has highlighted the need for more scholarly research on KE policies in order to reduce the gap between backward countries and benchmark nations (Asongu 2017b). To the best of our knowledge, no study has systematically reviewed the existing KE literature in order to provide policy makers with the much needed policies and strategies essential for the catch-up process. Therefore, there is need for research that could bridge the identified gap by organising what is known so far in the KE literature on catch-up lessons and strategies.

[4]It is important to note that the historic route set by Japan has paved the way for the Newly Industrialised Economies of Asia (Taiwan, South Korea, Singapore and Hong Kong) including China and Malaysia. These nations have been witnessing a tremendous progress from post-industrialisation 'product-based economies' to the era of 'knowledge-based economies'.

It the light of the foregoing, the research question answered by this inquiry is: what evidence is documented in the recent literature with regard to policies and strategies with which the progress towards knowledge-based economies can be consolidated in Africa? The knowledge economy policies and strategies are structured along three main pillars of the World Bank's knowledge economy index: education and skilled population, economic incentives and institutional regime and, information and communication technology (ICT). The rest of the study is organised in the three main dimensions of the World Bank's Knowledge Economy Index. The methodology of the systematic review is provided in Section 2. Section 3 and Section 4 are focused respectively on education and information and communication technology. Section 5 discusses economic incentives and institutional regime. We conclude in Section 6 with a summary of policy recommendations and future research directions.

2. Methodology of systematic literature review

This systematic review involves studies collected between July 2016 and January 2017 after an extensive search from multiple scientific sources, namely: Economic Papers, Science Direct, Economic Literature (Econlit), Google Scholar, the mainstream Google search engine and Research Papers in Economics (RePEc). Selected studies largely focus on Africa and were cross-checked to identify other references; regardless of methodological underpinning. The outcome of this examination is the identification of the relevant articles which articulate lessons and strategies from the perspective of education and skilled population, economic incentives and institutional regime, ICT and innovation systems. This approach is consistent with Asongu and Nwachukwu (2018a).

During the selection of relevant references, for the most part, studies published over the past ten years are considered. Some foreign publications are not taken into account because corresponding English versions are not available. Moreover, in order to articulate the "conceptual independence" approach in systematic reviews, we neither reject studies that assess different countries with the same methodology nor studies devoted to a particular group of nations with different methodological underpinnings.

It is relevant to clarify the fact that there is yet no consensus in the literature on the manner in which studies within the framework of a systematic review should be collected. While some authors in the literature include all information from a given study (Florax et al. 2003), one

preferred observation per study is adopted by others (Stanley 2001). The analytical approach adopted by this study consists of combining both approaches. This is essentially because while we articulate quantitative/direct contributions to the literature from the reviewed papers, qualitative/indirect contributions are also worthwhile. Therefore, in this paper, an indirect contribution to the literature is construed as a study which guides policy on building knowledge economies without establishing a causal empirical relationship. In the same vein, a direct contribution reflects an empirical investigation that culminates in the establishment of an effect from which knowledge economy policies can be derived.

In the light of the above, three main steps were employed for the systematic review. *First*, a two-week pilot study was engaged during which insights into a tentative structured approach were gained by the researchers. The corresponding insights into elements of knowledge economy include: increasing educational quality; balancing general education with technical education; increasing Research and Development; lifelong learning; ICT; economic incentives; institutional regime; innovation, intellectual property rights (IPRs) regimes; patents; trademarks; innovation; scientific publications; traditional PhD versus PhD by Publication; the digital economy and contemporary industrialisation. Second, a review of strategies and solutions to driving KE in Africa is classified into the three main themes or pillars of the World Bank's knowledge economy index, notably: (i) education and skilled population, (ii) economic incentives and institutional regime and (iii) ICT. At this stage, a detailed literature review is carried-out and the relevant references and main arguments are classified into the dominant themes. This leads to a word count of above 20 000. Third, the main arguments are compared and contrasted across and within the main themes in order to limit repetition as much as possible and hence to improve clarity of expression and readability. The outcome of this step is a synthesised narrative of about 50 percent of the initial "word count".

It is important to clarify that, the insights that emerged from the pilot study are notions and terms surrounding the concept of knowledge economy which are subsequently consolidated within the framework of the World Bank's conception or pillars of knowledge economy. Hence, the identified insights are further incorporated into one of the three engaged pillars of the World Bank's Knowledge Economy Index. Accordingly, the pilot study enabled the research to have insights into various strands of knowledge economy that were subsequently conceptualized and merged within the framework of the World Bank's Knowledge Economy Index. Hence, the

systematic literature review process is ad hoc in terms of operative procedure. To the best of our knowledge the insights have not been systematically summarized into the components of the World Bank's Knowledge Economy Index.

3. Education and Skilled Population

This knowledge economy dimension is concerned with the ability of the educated and skilled population to create, disseminate and use knowledge efficiently. Shortages in educational investment and growing brain drain have been documented to represent the major concerns limiting the drive toward KE in Africa (Ford 2007; Kamara et al. 2007; Amavilah 2009; Chavula 2010; Weber 2011; Anyanwu 2012; Andrés et al. 2015; Tchamyou 2017). The underlying literature is consistent with the depleting background on knowledge infrastructure, the burgeoning brain drain, limited research and development (R&D), outdated curricula and the restricted relationships between industry and science. In essence, African economies are in a slippery KE path (Anyanwu 2012) and could substantially lose the new drive toward KBE unless bold policies are taken to reinvent technology and science, higher education and innovation (Kamara et al. 2007).

On this dimension, economies in Africa need to take ambitious policy measures towards increasing, *inter alia*: quality educational enrolment; technical education that is substantially outweighed by general education and expenditure in R&D. Moreover, a culture of lifelong learning is needed so that workers are trained to adapt to challenging and evolving technological conditions. Policy makers need to establish mechanisms with which to provide on-the-job vocational and technical training. Such policies should move hand-in-glove with incentives for workplace training by corporations. Countries should rely on the importation of very expensive technology that its research units cannot afford, and its R&D platforms should be more indigenously-oriented and tailored towards local needs like food security and food self-sufficiency (Asongu 2016).

3.1 Increasing educational quality

It is important for African countries to engage in bold steps with the aim of boosting qualitative college enrolments. For such policies to be effective, they should be tailored in conjunction with considerable ameliorations in complementary institutional environments which include the autonomy and capacity of higher learning institutions. In essence, education boosts a country's ability to gain novel knowledge and technology. Education also produces the tacit knowledge of individuals which is needed to buttress technological learning blocks. It is within this framework that governments in African nations have to implement the necessary measures with the target of promoting essential human resource development (Tchamyou 2017). Recent literature on policy measures that can be tailored toward increasing educational quality in Africa can be discussed in four main strands. They are: (i) a social justice framework, (ii) outcome based education, (iii) pedagogical renewal for qualitative universal primary education and (iv) the internationalization of higher education. These are presented chronologically.

First, from a social justice framework, Tikly and Barret (2011) have discussed an approach founded on a theory of capabilities and social justice. The study involves an understanding of how the quality of education is explained within the framework of how it improves essential capabilities that are valuable to communities, individuals and the society as a whole. Three inter-related dimensions of educational quality are analysed from a perspective of social justice: (i) the first element articulates the various factors that grease the enhancement of learner capabilities (e.g. limiting institutional and cultural barriers) and consolidates learning processes from different groups; (ii) the second aspect is focused on the degree by which externalities in education are held in high esteem by their communities and in line with development priorities from a global perspective; and (iii) the dimension of democracy envisages how educational quality decisions are governed as well as the nature of participation of learners in local, national and global debates.

Michealowa (2001) assessed the most efficient mechanisms by which learning competencies for a substantial number of children can be ensured. The author laid emphasis on four key policy options for efficiency. They comprised: (i) working towards addressing cross-country contextual settings and constraints in initial conditions of the educational systems; (ii) optimizing the mix of educational inputs through, among others, the availability of more text books in homes and the provision of access to public libraries and opening of mobile libraries in rural communities; (iii) enhancing the capacity to transform inputs into effective learning through institutional and motivational factors; and (iv) re-evaluating the cost of input characteristics.

Second, with regard to outcome-based education (OBE), according to Botha (2002), OBE is an academic philosophy that was introduced in South Africa in the post-apartheid era to tackle demands for a work force that is increasingly skilled. OBE comprises curriculum-related reforms that were issued by South Africa's government after the first democratic elections in 1994 in order to make education more readily available and eliminate educational inequalities that existed in the apartheid era (Jansen 1998). This system is based on the assumption that it would improve education quality attained by South African learners in school. Therefore, OBE is a theory in education that is founded on the educational goals or outcomes. With regard to the outcome of the educational experience, a goal should be achieved by each student. There is not a one size fits all teaching or examination in OBE. According to the narrative, assessments, opportunities and classes should instead enable all students to achieve specific goals. The essence of this narrative is to adapt to trainer, mentor, facilitator and targeted results.

Consistent with Lomofsky and Lazarus (2001), it is also important to note that, policy development within this framework has been oriented by universal tenets of human rights to equality, education and acknowledgement of democratic rights within broader contexts (including all learners, teachers and people with disabilities). The authors have articulated that some policy reforms in education have recommended a shift in the understanding of 'special needs and support services' in a nation vis-à-vis an inclusive training and education system.

Third, within the framework of pedagogical renewal for universal primary education of quality, Dembélé and Lefoka (2007) have recommended reforms in both teacher development and pedagogical renewal as a means of improving universal primary education in Sub-Saharan Africa. Open-ended institutional practices and bilingualism are suggested as some promising strategies. Moreover, improvement in coordination, decentralisation and privatisation of education are important. According to Geo-Jaja (2004), such schemes have resulted in no educational developments in some countries like Nigeria.

Fourth, from the measurement of globalisation and/or internationalisation, Albach (2007) maintained that internationalisation involves practices and policies that are engaged by individuals and academic systems/institutions in order to meet challenges imposed by the global academic environment. Some drivers of internationalisation entail *inter alia*: the boosting of the curriculum with international content, acquisition of knowledge and new languages and commercial

advantages. Moreover, efforts devoted toward ensuring quality and monitoring of international initiatives are part and parcel of the global environment of education.

According to Oyewole (2009), the internationalisation of higher education has the promise of enhancing the quality of the curriculum, programmes of students, facilities and staff in systems of higher education. Unfortunately, in some African regions where appropriate regulatory channels are not in place, higher education can be threatened by internationalisation via activities of questionable learners and foreign providers.

3.2 Balancing general education with technical education

There is a consensus in the literature that general education substantially outweighs technical training in African countries (Oketch 2007). Thus, the imperative of balancing technical education with general education was adopted as part of the African Union's (AU's) policies (AU 2006). According to the narrative, technical and vocational education, which for the most part is concerned with preparing citizens for the job market, is the area of schooling that has to be emphasised in Africa in order to address growing concerns of unemployment and poverty in the sustainable development agenda. This description is supported by the recent literature on the need for technical skills in entrepreneurship. Most notably, Mensah and Benedict (2010) observed the long-term poverty-reducing consequences of training for entrepreneurship instead of government hand-outs for survival while Gerba (2012) remarked on the positive relationship between entrepreneurial lessons in schools and doing business.

The foregoing argument is consistent with the position that a knowledge economy in the 21st century is characterised by changing labour market demands which require technical and vocational education and training (TVET) to regularly adapt to the needs of students to secure employment. In theory, TVET which should be a core part of everybody's education is a mechanism whereby individuals in both rural and urban areas are empowered to take control of their lives. A sustainable TVET programme incorporates, *inter alia*: a sound system of general education, specialised technical training, a system conducive to introductory/general technical education and avenues of credit transfer to consolidate training and education.

It is important to note that in the absence of avenues of employment, formal- and 'non-formal' TVET-related programmes that are consolidated (e.g. by counselling, career guidance and entrepreneurship training) could enable citizens to become self-employed. Whereas TVET also

substantially offers opportunities with which to emerge from disasters and civil conflicts, it also endows the possibility of making a transition from the informal to the formal economy.

In the light of the above, a quality technical and vocational education and training (TVET) that responds to the requirements of the labour market needs to be created by educational institutions in collaboration with future employers. Such programmes are acknowledged as imperative for providing equipment to the growing number of young citizens finishing basic schooling. Moreover, TVET also provides opportunities of preserving and boosting cultural practices and indigenous knowledge, for example by means of enhancing traditional crafts and arts. Considering the high proportion of young people that have not gone through a formal educational process, the complementarity between TVET programmes and consolidated non-formal learning can be immensely beneficial for women and girls. Ultimately, these benefits are associated with positive externalities on African community wellbeing. In summary, TVET needs to be aligned with demands from the local market and R&D channels that seize advantages of avenues offered by the phenomenon of globalisation. An interesting strand of policy measures on how to improve TVET in Africa, which is available in Table 5 of the AU (2006) report includes: equitable access to TVET; quality and relevance of national TVET programmes and systems; non-formal education; capacity building; financing TVET and the employment of network strategies.

3.3 Increasing Research and Development

As suggested in recent African KE literature (Asongu 2017b), it is important for countries to rely on the importation of overpriced technology that is very expensive for its research units to accommodate and tailor their research platforms toward affordable indigenous-focused research like food self-sufficiency and security. Some policy recommendations for increasing R&D in Africa include: (i) incentives for indigenous-oriented scientific research, (ii) measures against brain drain, (iii) encouragement of regional collaborative R&D and (iv) amelioration of communication channels between experts and policy makers.

First, while a consensus has been reached in the literature on the relevance of locally-tailored research in the consolidation of indigenous and national absorptive capacities (see Asongu and Nwachukwu 2018b), the setting of research standards is crucial for locally-oriented research. Peer review enables scientific rigour in the process and more importantly, the outcome substantiates the suitability of research that is underpinned by local interest and implementation.

In addition, the connection between research and industrial development can be increased by encouraging researchers to have their scientific products peer-reviewed and published. Doing so in top tier journals entails some additional charges (especially in terms of submission fees), therefore substantial incentives should be provided to researchers who are willing to contribute to knowledge in areas of academia that are closely linked to industrial development. This policy direction is supported by the literature. This suggests that the low rate of research published on Africa is fundamentally traceable to the lack of finance and inadequate inducements (Ondari-Okemwa 2007).

Second, from the perspective of the brain drain, in order to increase R&D at local and national levels, researchers that are based abroad need to collaborate/connect with their peers working in their countries of origin. These partnerships of international nature could include, among others, mentoring of youths in research and insights into channels via which research findings can be associated with the development of the local/national industry. It is important for governments on the African continent to also take essential measures to see to it that qualified scientists that are leaving in search for better working conditions and greener pastures constantly keep-in-touch with national/local universities. This measure is particularly important because with growing standardization of diplomas and university certificates, most researchers in less developed countries that receive the relevant research training abroad, seldom return to their home countries/universities to contribute to knowledge by means of research and development. Genuine efforts devoted to stemming the tide should not be exclusively country-specific, but be tailored through international and regional policy initiatives.

Third, the promotion of regional research and innovation is important in order to enable lagging nations to catch-up their frontier counterparts in terms of R&D. Such a promotional venture could focus on, among others, validating and encouraging activities that lay emphasis on local/regional initiatives in the promotion of new businesses. The ventures could also entail the cross-country construction of appealing environments for collaboration in R&D. The corresponding networks may border around the following ideas: (i) cooperation from a transitional setting with the purpose of facilitating catch-up in science and R&D; (ii) orientation of R&D programs to involve regional policy makers and local actors and (iii) integration of and emphasis on nations in the continent that have achieved more development (e.g. poverty and income-inequality reductions) by enhancing R&D.

Fourth, cross-country policy initiatives in the three categories above can be enhanced in the presence of adequate information and communication facilities between researchers, industries and policy makers. Building complementary/joint platforms and networks of communication is a means of enhancing such correspondence between various stakeholders. Moreover, lessons from successfully implemented projects need to be properly communicated and documented in order to serve as role models for other R&D networks. Such communication and documentation should encompass clear data and statistical indicators upon which existing and potential collaborative networks can leverage in order to promote R&D.

An example of a collaborative initiative that is meant to fight brain drain, promote research and cross-country policy measures is the 'African Diaspora Support to African Universities' that is tailored by the Council for the Development of Social Science Research in Africa (CODESRIA) (CODESRIA 2014). The initiative aims to mobilize African researchers in the diaspora to contribute towards: consolidating African universities, revitalizing social sciences, filling gaps in teaching, strengthening PhD programmes and mentoring young researchers in social sciences. More generally, the CODESRIA scheme aims to boost relations between African universities and African academics in the diaspora and their institutions.

In summary, R&D platforms are essential for building a Knowledge-Based Economy because while an exemplary country like South Korea imported a considerable amount of its technology from more developed countries, about 3 percent of its GDP was allocated for R&D purposes (Suh and Chen 2007; Tchamyou 2017).

3.4 Lifelong learning

In the process of building African knowledge economies, a culture of lifelong learning is vital in order for workers in particular and society in general to continually adapt to the evolving and challenging conditions of the labour market. It would be important for policy makers to provide

channels that enable on-the-job vocational and technical training. Such measures should be tailored hand-in-hand with incentives for training in the work place.

To be sure, in order for workers to adapt to evolving technological conditions, governments in Africa would need to provide vocational and technical training as well as engage the necessary steps toward encouraging training in work places. The motivation behind the underlying strategy is that as countries develop, technological competence becomes even more critical to sustain this economic progress. In order for such measures to be successfully implemented, it is relevant for policy makers to nurture high calibre scientists and engineers that are able to manage the prosperity on science and technology frontiers. A case in point is the Korean experience in which education and industrialization are complemented in order to boost and sustain economic development. Accordingly, technological learning and industrialisation resulted from education on the one hand and on the other, industrialisation in turn increased the return on educational investment which further enhanced the demand for education (Suh and Chen 2007; Tchamyou 2017; Asongu and Tchamyou 2019b). In summary, as argued by Suh and Chen (2007), the relationship between human development and education was tailored into a lifelong learning strategy.

Such a lifelong learning strategy has been broadly articulated by the African Union's educational plan (AU 2006), "*To re-align education systems in Member States so that young people are provided with compulsory basic education which imparts key generic competencies, skills and attitudes that lead to a culture of lifelong learning and entrepreneurship in order to empower individuals to live in peace and harmony, engage in the world of work, alleviate poverty and pursue further learning*" (p. 9). The priority areas for policy intervention are discussed in Table 5 of the AU (2006) report.

4. Information and Communication Technology (ICT)

There are a multitude of benefits from ICT penetration in economic growth and sustainable development (African Partnership Forum 2008; Asongu 2016; Gosavi 2018; Minkoua Nzie et al. 2018; Isszhaku et al. 2018; Abor et al. 2018). Such may include the fact that ICT facilitates the effective creation, dissemination and processing of knowledge. The economic importance of these

benefits is more apparent when ICT penetration in Africa is compared to the rest of the world (Penard et al. 2012; Asongu and Nwachukwu 2016a, 2016b; Tchamyou et al. 2019). Indeed relative to other regions of the world, there is a higher penetration potential of ICT mechanisms in Africa. According to the narrative, while high-end countries in Asia, Europe and North America are currently experiencing points of saturation in ICT growth, there is substantial room for its penetration in Africa. The logical implication is that policy can leverage on the corresponding penetration potential to tackle development concerns.

In the light of the above, ICT has recently been documented to contribute to sustainable and inclusive human development, in terms of: gender empowerment (Maurer 2008; Efobi et al. 2018; Asongu and Odhiambo 2018a; Uduji and Okolo-Obasi 2018a, 2018b, 2018c; Asongu and Boateng 2018; Uduji et al. 2019); boosting of financial inclusion (Kirui et al., 2013; Singh, 2012); access to health care from the population in the low socio-economic strata (see Kliner et al. 2013; Asongu and Odhiambo 2019a, 2019b); mitigation of the developmental divide between urban and rural areas (Chan & Jia, 2011); purging of agricultural wastes as well as demand- and supply-side constraints/mismatches (Muto and Yamano 2009; Aker and Fafchamps 2010); consolidation of business opportunities, especially for small and medium sized corporations (Mishra and Bisht 2013; Nour 2018); informal financial sector development (Asongu 2013b); household management efficiency (Al Surikhi 2012) and promotion of inequality-adjusted inclusive human development. Despite the substantially documented positive development effects of ICT (also see Ureta 2008; Asongu and Nwachukwu 2018c), Mpogole et al. (2008) have cautioned that ICT should not be construed as a silver bullet for economic development. This implies that corresponding policies need to be carefully tailored to leverage the ICT potential, especially in development sectors that are proven success stories.

Whereas there is a wide consensus on the socio-economic rewards of ICT in African countries, some fundamental setbacks to access still persist like concerns about affordability and absence of infrastructure. A relevant policy direction should be the implementation of measures which contribute toward improving the much required infrastructure for enhanced ICT penetration and/or universal access mechanisms. Furthermore, reverse ICT engineering could consolidate the base of ICT on the continent, reduce operational dependence as well as mitigate the cost of acquiring technology. In East Asia for instance, leading countries like South Korea have fundamentally built their economies by synergising ICT with other policies, notably an active

informatization policy with industrial measures that are combined with sound competitive and regulatory policies.

Accordingly, the ICT success of South Korea is hinged on massive investment in internet equipment, multimedia and telephone lines, *among others*. These investments considerably contributed to economic growth and human development. In accordance with Suh and Chen (2007) and recently Tchamyou (2017), the ICT policy of South Korea was clearly articulated along perspectives which encompassed three policy areas, namely: (i) an industrial policy (R&D, human resources and venture capital), (ii) a competitive and regulatory policy (market liberalisation and privatisation); and (iii) an active information policy (setting-up of electronic-government and construction of an advanced infrastructure). As substantiated by Asongu (2017b), integrating the three areas of policy measures within a complementary framework has been fundamental to South Korea's successful ICT strategy. Therefore, African economies could build on insights into such policies which are the foundations of South Korea's exceptional development in its knowledge economy. As discussed earlier, reverse engineering of imported ICT technology and less tight IPRs on ICT are steps in the right direction towards consolidating an African ICT base. Moreover, such policies could drive-down dependence on business operations and the cost of technological acquisition.

5. Economic Incentives and Institutional Regime

Economic incentives and institutional regimes are major concerns in the building of KE (Cogburn 2003; Letiche 2006; Zghidi et al. 2018; Sağlam 2018; Tchamyou 2019a; Asongu and Odhiambo 2019c). Good institutions are essential for the development of African economies. Moreover, this pillar of the knowledge economy is complementary to the institutional reforms which are needed to encourage entrepreneurship and for the efficient use of existing and new knowledge in African countries. These reforms may involve initiatives to reduce (i) poor governance (Andrés et al. 2015), especially the role of corruption in consolidating intellectual property rights (IPRs) (Andrés and Asongu 2013); (ii) excess liquidity in African banking institutions that is limiting access to finance (Saxegaard 2006; Triki and Gajigo 2014).

5.1. Economic Incentives

Consistent with the narrative above, extensive (or export-led) development strategies would expose African economies to more competition. Whereas an outward-looking strategy could spur intensive programmes in R&D, fiscal inducements from domestic governments are relevant for the success of such strategies. Along the same line of thinking, measures of protectionism which are for the most part relevant at the early stages of industrial development should be curtailed in tandem with economic development. This is essentially because complacency in innovation is often the result of lack of exposure to competitive forces.

Private credit incentives and measures in the fight against excess liquidity are essential to address the substantially documented concerns of surplus liquidity (Saxegaard 2006; Triki and Gajigo 2014; Asongu and Odhiambo 2018b; Tchamyou 2019b). This would require the consolidation of information sharing offices or credit bureaus that are required to mitigate information asymmetry between lenders and borrowers in the African banking industry (Barth et al. 2009; Singh et al. 2009; Triki & and Gajigo 2014; Tchamyou and Asongu 2017; Boateng et al. 2018; Kusi and Opoku- Mensah 2018; Kusi et al. 2017). Tackling the concern of surplus liquidity would stimulate the private sector and address fears in the evolving literature on the need for investment (Anyanwu 2007, 2009) and more financial access on the African continent.

Governments adopting extensive growth strategies should simultaneously provide incentives (e.g. fiscal incentives and subsidised R&D programmes) with which to protect African industries from foreign competition in the short run. Protectionist measures are welcome at the early stages of industrialisation because, whereas industrialised nations used protectionist policies at the early stages of their industrialisation, the neoliberal economic model prioritised by the Washington consensus promotes private capitalism and free market competition.

Unfortunately, even by European and the United States' standards, the free market ideology is strategically designed to stifle free market competition that directly affects Africa's industrialisation process and its quest for knowledge-based economies. We substantiate this perspective with three examples. According to Joseph Stiglitz in 'Making Globalisation Work', the United States would not be at the forefront of exporting cotton to the rest of the world, but for subsidies offered by the US government. The same narrative maintains that with a subsidy of 2 USD per cow/day in the European Union, it is better to be a cow in Europe than a human being in Africa where most of the population still lives with less than 2 USD/day. Above all, the principles of comparative advantage underpinning the neoliberal ideology can hardly be respected with a

European Union that allocates about half of its budget subsidies to agriculture and the agri-foods industry that represent around 6 percent of its GDP (Asongu and Nwachukwu 2016c).

In the light of the above, whereas protectionist policies are needed in Africa at this early stage of industrialisation, they should be ultimately curtailed in order to mitigate complacency in innovation. A means of providing incentives to small and medium sized corporations that are characterised by greater capital requirements and risks is to use government-run research institutes for collaborative R&D.

5.2 Institutional Regime

A fundamental cause of Africa's underdevelopment is poor institutional quality. Market-focused institutions are essential in the continent as a development strategy in order to substantially liberate competitive forces that are relevant in the drive toward knowledge-based economies. Hence, because a strategy that is market-oriented needs competitive forces, conditions for KE are also likely to be enhanced. Therefore, factors like government accountability, levelled playing fields for all participants in the market, liberalised trade and foreign investment regimes are essential for KE.

African economies can also consolidate their institutional regimes by designing policies that support institutions in: (i) asserting national credibility during crises; (ii) co-opting corrupt elites into investing in long run development projects; (iii) exposing African corporations to international competition as they mature; and (iv) promoting avenues that liberate competitive forces that are indispensible in knowledge-based economies.

One of the appeals of developing credible institutional regimes is that it potentially mitigates capital flight and enhances foreign investment. For instance, with the South Korean experience after its 1997 crisis, policies implemented by the government were successful for the most part because the government had credible domestic and international institutions. Governments in Africa can leverage on such lessons especially the acknowledgement of long-run fiscal prudence by the government of South Korea which enabled it to put adequate post-1997 reforms in place. The measures included removal of non-performing loans, recapitalization of financial establishments and provision of financial support for households with low-incomes and unemployment-related social programmes. Thanks to sound institutional regimes, fiscal prudence and financial credibility, the South Korean government could issue novel bonds in order to raise

the funds needed to finance reforms. In the light of the above, African governments need to beware of the fact that their ability to successfully manage financial and economic crises is contingent on some amount of institutional reliability.

Another very relevant institutional issue in Africa is corrupt political elites (Garoupa and Jellal 2007; Jellal and Bouzahzah 2013). Still building on the South Korean narrative, instead of cracking-down on the corrupt elite as the government was urged to do by the USA, the leader adopted a more practical approach of expropriating shares of the corrupt elite in banks and obliging that the elite invest in industries that favoured import-substitution (Tran 2011). This strategy of dealing with corruption is particularly relevant to African countries which on average lose about 25 percent of their annual GDP. Generally speaking, the above narrative of the Korean approach is in line with the perspective that a credible government is essential for the successful implementation of KE strategies. As seen above, the pivotal role of the government of Korea has been very remarkable. The South Korean government has been visionary in ensuring effective leadership that enabled a favourable macroeconomic environment for KE: domestic R&D initiatives, access to modern infrastructure, training of the population, mass education, and the assimilation of foreign technologies, among others.

6. Conclusion and future research directions

Compared to other regions of the world, African countries are lagging in their drive toward knowledge-based economies. This study has systematically reviewed policies and strategies with which African countries can accelerate their current drive towards knowledge-based economies. These have been discussed in terms of three pillars of the World Bank's knowledge economy

index, namely: (i) education and skilled population, (ii) information and communication technology; and (iii) economic incentives and institutional regime.

The practical implications of the research can therefore be summarised into the three attendant World Bank knowledge economy pillars. First, in order to promote quality education and improve conditions for an ever-growing skilled population, the research has recommended that it is worthwhile for countries in Africa to take on board ambitious policy measures that are tailored towards, *inter alia*: quality educational enrolment; technical education that is substantially outweighed by general education and expenditure in R&D. In addition, a culture of lifelong learning is indispensible so that workers are trained to adapt to challenging and evolving technological conditions. Policy makers are also encouraged to establish mechanisms with which to provide on-the-job vocational and technical training. These policies should be implemented concurrently with workplace training incentives in businesses of all size. It is also recommended that nations should favour the importation of very expensive technology that its research units cannot afford to develop, and its R&D platforms should be more indigenously-oriented and tailored towards local needs like food security and food self-sufficiency.

Second, on the front of ICT, it is recommended to formulate and implement measures which contribute towards improving the much required infrastructure for enhanced ICT penetration and/or universal access mechanisms. Moreover, reverse ICT engineering could consolidate the base of ICT on the continent, reduce operational dependence as well as mitigate the cost of acquiring technology. Success stories on which the policy implication build have substantially consolidated their knowledge economies by synergising ICT with other policies, notably an active informatization policy with industrial measures that are combined with sound competitive and regulatory policies. Such ICT enhancement strategies are clearly articulated along frameworks which entail three policy areas, namely: (i) an industrial policy (R&D, human resources and venture capital), (ii) a competitive and regulatory policy (market liberalisation and privatisation); and (iii) an active information policy (setting-up of electronic-government and construction of an advanced infrastructure).

Third, some recommendations are also provided in view of providing more economic incentives and enhancing institutional regimes, *inter alia*: (i) from the angle of economic incentives, while protectionist policies are needed in Africa at this early stage of industrialisation, they should be ultimately curtailed in order to mitigate complacency in innovation. A means of

providing incentives to small and medium sized corporations that are characterised with greater capital requirements and risks is to use government-run research institutes for collaborative R&D. (ii) With regards to improving institutional regimes, credible governments are essential for the successful implementation of KE strategies. Hence, governments need to be visionary in ensuring effective leadership that enable a favourable macroeconomic environment for KE: domestic R&D initiatives, access to modern infrastructure, training of the population, mass education, and the assimilation of foreign technologies, among others.

Whereas we have attempted to provide some policy directions which can enable lagging African countries to catch-up their more developed counterparts, the transition from product-based to the knowledge and/or digital economies remains the responsibility of all. This means that neither technology nor the corresponding disruption that is associated with it is exclusively exogenous to human control. Citizens through daily choices and activities can help in grasping opportunities that knowledge-based economies are offering to create jobs and lift millions out of poverty. For this end to be clearly understood by scholars and policy makers, it is worthwhile for future research to investigate empirically how knowledge-based economies contribute towards creating jobs and reducing poverty. The further research recommendation is also motivated by projections that the population of Africa is estimated to double by 2036 and represent 20 percent of the population in the world by 2050 (UN 2009). Moreover, as empirically demonstrated by Asongu (2013), the corresponding unemployment accruing from the underlying demographic change would be accommodated by the private sector (vis-à-vis the public sector) which requires knowledge-based economy orientations for efficiency in organisation and production.

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